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BROOKLYN BOTANIC GARDEN
LEAFLETS

SERIES XXVIII BROOKLYN, N. Y., MARCH 19, 1941

No. 1-3

**THE BROOKLYN BOTANIC GARDEN
EXHIBIT OF AN IVY GARDEN**

**Together with a collection of more than seventy
species, varieties, and forms of *Hedera***

INTERNATIONAL FLOWER SHOW

MARCH 17TH TO 22ND, 1941

The name "Ivy" has been applied to numerous plants of vastly different appearance and family relationship, but having in common a vine-like habit of growth. Thus we have Boston Ivy, English Ivy, German Ivy, Ground Ivy, Japanese Ivy, Poison Ivy, and Kenilworth Ivy. When the name is used without any qualification it implies a member of the genus *Hedera*.

According to Rehder¹, *Hedera* contains five species in Europe, North Africa and Asia, namely: *canariensis*, *colchica*, *Helix*, *nepalensis*, and *rhombica*. They are evergreens of climbing habit. All of these species are represented in the Exhibit, but it is *Hedera Helix*, the English Ivy, in a bewildering array of varied forms, that is predominant.

Those who have had anything whatever to do with an attempt to straighten out the tangled nomenclature of the multitudinous forms of *Hedera Helix* must feel that had Linnaeus called the English Ivy *Hedera mutabilis* it would have been a far more appropriate name, for surely there is no species in the plant world which is so consistent in its changeability as this one! In some of the garden forms it is possible, without very much trouble, to select a dozen leaves from a single branch, of such variety in shape, size and color that anyone unfamiliar with the vagaries of Ivy would swear they came from a dozen different plants. And this is not all. Some varieties react more violently than others to environment—light, temperature, type of soil, modes of culture—and in consequence they may show seasonal differences from their neighbors (in color, size, and shape of leaves) which are not discernible throughout the whole year.

¹ Rehder, Alfred. Manual of cultivated trees and shrubs hardy in North America. 2nd ed. p. 672ff. The Macmillan Co., New York, 1940.

Another complication is provided by the arborescent stage of growth. Practically every kind of *Hedera* starts out in life as a plant which climbs by means of adventitious rootlets. When a certain stage is reached, or when it has attained the top of its support, its character changes completely and the arborescent form is produced, characterized by rigid branches and bushy appearance in contrast to the flexible shoots of the climbing type. The leaves lose their normal lobed character, flowers and fruit are produced and the uninitiated would think that a shoot from the arborescent stage had no connection whatever with one from the vining stage.

If cuttings from arborescent forms are rooted (sometimes this is difficult) they will grow and perhaps continue as sturdy, rounded bushes. In this state they form a familiar feature of many of the gardens of England. If, however, the gardener is so unwise as to plant a bush-like form in proximity to a wall, tree trunk or other satisfactory climbing surface, the chances are that new shoots from the bush will discard their twiggy habit and revert to the climbing stage of their ancestors. Often they may exhibit an intermediate or semi-arborescent form prior to passing into the climbing stage. An old specimen, included in the Exhibit, was for many years strictly arborescent but now has both kinds of growth. In addition to all this, even though the plants may retain their scandent habit, young plants raised from cuttings are likely to have shoots vastly different in appearance from those which are produced at a later stage in growth. There is some indication that grafting Ivy may provide a further complicating factor. Several examples of Ivy made into "weeping" standards, etc. by grafting are included in the Exhibit. One of these, an understock of *H. H. hibernica* trained to gridiron shape, has grafted on it sixteen forms and varieties. A feature of this specimen is that several of the scions now show a tendency towards semi-arborescent growth.

Alfred Bates, who has made a special study of *Hedera* for many years, and to whom our thanks go for aid in assembling and naming our collection, has published a series of articles in the "National Horticultural Magazine" under the general title "The Illusive Ivy." One cannot help feeling that no more accurately descriptive phrase could be devised for this group—except perhaps "The Elusive Ivy"!

It is in the arborescent stage that the flowers of *Hedera* are produced—in umbels which may be solitary or arranged in a raceme. The flowers are small, greenish, and unattractive except possibly to insects. I remember many years ago in England having my attention called to an enormous bush of *Hedera* by the loud and continuous buzzing of flies, similar to "bluebottles," which presumably were engaged in gathering nectar. The fruits, usually black in *Hedera canariensis*, *rhombica*, and *colchica*, might be considered ornamental—they are decidedly so in the case of *nepalensis* in which, according to Rehder, they are yellow or red. Our plant has orange fruit.



FIGURE 1.—*Hedera Helix*, arborescent stage, growing on college wall on banks of Cam (England). Kenilworth Ivy (*Linaria Cymbalaria*) growing in mortar between bricks of wall.

The arborescent form is seldom produced out-of-doors in the vicinity of New York, and in consequence *Hedera* is not grown for its flowers or fruits in these parts, but this does not mean that it is valueless. Given a suitable location protected from winter sunshine and from high winds, several varieties of *H. Helix* are capable of climbing and thriving on unpainted walls of brick or stone, on tree stumps, or on living tree trunks. Included in this group are *H. H. hibernica*, *pedata* and *palmata*. *H. colchica* is said to have been growing on a wall in northeastern Pennsylvania for sixty years. Still more kinds are adapted for use as ground covers, and are especially valuable because they can endure shade sufficiently dense to inhibit the growth of grass. *H. colchica* is adaptable for this purpose, *H. H. hibernica* is quick-growing, and *H. H. baltica* is very hardy. Doubtless most strong-growing forms of *H. Helix* could be used as ground covers. *Contracta*, *gracilis* and the variegated forms are not reliably winter hardy in the Brooklyn Botanic Garden. *H. canariensis* and its varieties are said not to be hardy but we have not tried them outdoors here.

[It would be useful to know the geographical limits of hardiness of *Hedera*. The Department of Floriculture and Ornamental Horticulture of the New York State College of Agriculture at Cornell University has under way an Ivy project which includes a study of hardiness as well as nomenclature and other problems connected with *Hedera*. Not all the ivies in the list included in this Leaflet have been tried outdoors at the Brooklyn Botanic Garden, but those marked (*) have survived a winter outside and doubtless there are many others equally hardy. Those marked "T" we believe to be tender and unsuited for outdoor culture in the vicinity of New York.]

Another use for Ivy is as an edging to flower beds, etc. To do this a strong-growing variety such as *hibernica* is planted and its long trailing shoots pegged down to form a thin line. Future treatment consists of shearing the edging each spring just before growth starts, and of "tucking in," or snipping back, any "wild" shoots which make their appearance during the growing season. A low hedge may similarly be formed by providing a support on which the Ivy may be trained.

Ivies are enduring as house plants, but if your home is overheated (a winter temperature of 45 degrees is ideal for ivies) and no provision is made for humidifying the air, spider-mites are likely to raise havoc with the plants unless precautions are taken to prevent attack. One of the best prophylactic measures against spider-mites, and insects such as scales, mealy bugs, and aphids is a thorough spraying of foliage, at least once a week, with clear water. Usually the most convenient way of doing this is to place the plants on their sides in a bathtub (remove the stopper!) and apply the water forcefully to both sides of the leaves through the medium of a hose obtainable at any nickel and dime store.



FIGURE 2.—*Hedera Helix* var. *hibernica* (Irish Ivy) used as a flat edging. Laboratory Plaza, Brooklyn Botanic Garden.

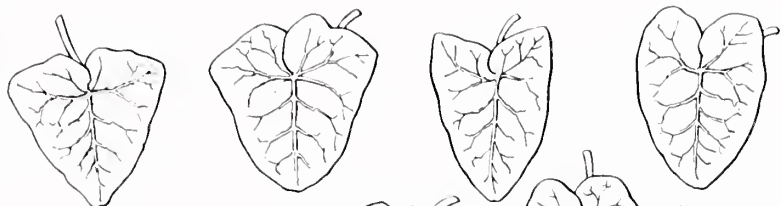


FIGURE 3.—*Hedera Helix*: arborescent stage with developing inflorescence.

Among the best kinds for house culture are Emerald Gem, *pedata*, minor, palmata, and Russell's Gold. These have flexible stems and need support, which may be a tiny trellis, a simple stake, or a wire or wood half-hoop. The variety *hibernica* is excellent for water culture. The recently developed, compact "self-branching" kinds such as Pittsburgh, Green Quartz, Merion Beauty, Green Feather and Maple Queen are preferable if it is desired to have growths droop over the side of the pot. Ivies form excellent subjects for hanging pots or "baskets," as may be seen from the specimens included in the Exhibit.

Ivy seems to be unusually tolerant in the matter of soil and is indifferent to acidity and alkalinity, except possibly in extremes. For pot culture it is perhaps advisable to use a soil that is not too rich, unless one desires lush growth. It should be pointed out that some Ivy fanciers believe that a lean soil is more conducive to the retention of leaf characters which distinguish the many "elusive" varieties; and that the coloration of the variegated forms is enhanced by a meager diet.

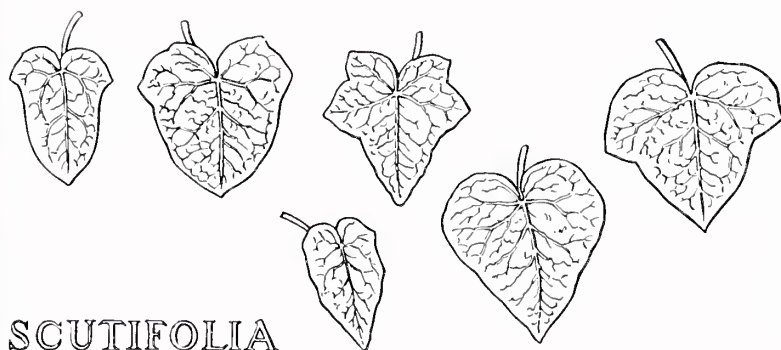
We have tried to attach correct names to all the species, varieties and forms of Ivy (seventy or more) included in the Exhibit but make no claim to infallibility. The naming has been based primarily on descriptions in Rehder's "Manual of Cultivated Trees and Shrubs," Tobler's "Die Gattung Hedera"; "The Ivy, a Monograph," by Shirley Hibberd; Nicholson's "Dictionary of Garden-



DELTOIDEA



PEDATA



SCUTIFOLIA

showing variations in leaf form

FIGURE 4.—*Hedera Helix* varieties.

ing"; and Bean's "Trees and shrubs hardy in the British Isles" have also been used. For recent varieties we have depended in part (not much) upon catalog descriptions; and when possible, have obtained varieties directly from the introducer or distributor in order to be sure of authentic specimens.

While the number of names has been reduced by some "lumping" together of forms which seemed too much alike, there are doubtless many varieties included under different names which to the casual observer will seem indistinguishable. In this connection it is desirable to remind the reader that response to environment may result in easily visible differences at another season.

ALPHABETICAL LIST OF IVIES, WITH NOTATIONS, IN BROOKLYN BOTANIC GARDEN EXHIBIT AT THE INTERNATIONAL FLOWER SHOW

‡ Probably winter-hardy in Brooklyn and vicinity.

T Tender or not reliably winter-hardy in Brooklyn.

Names of species, varieties, and forms described in Rehder's Manual are in italics.

T *Hedera canariensis*. Canary Islands, Madeira, North Africa.

T *algeriensis*

T *azorica*

T Gloire de Marengo

T *maderensis*

T *variegata*. Two forms.

H. algeriensis, *H. azorica* and *H. maderensis* are considered by some botanists to be synonymous with *H. canariensis*. We have, however, six distinct kinds belonging in the *canariensis* group. For the want of better and more authoritative names we are temporarily using the above designations as a means of distinguishing those which we have.

* *Hedera colchica*. Asia Minor, Caucasus, to Persia.

amurensis

* *dentata*

 semi-arborescent form

variegata

Hedera colchica and its varieties have large (up to 7 in. x 10 in.) leathery leaves, usually entire, rounded or heart-shaped at the base, scaly pubescence on young growth. Hairs with 20 to 25 rays. Bean¹ says:

¹ Trees and shrubs hardy in the British Isles, W.J. Bean.

"The finest form of *H. colchica* is commonly known as "*H. amurensis*" but I can find no authority for the name." Our specimen received from the Royal Botanic Gardens, Kew, is not sufficiently advanced to be distinguished from *H. colchica*.

Hedera Helix and its varieties, forms, and sports.

* *Hedera Helix*. Europe to Caucasus.

Albany (see *Pittsburgh*)

angularis aurea

arborescens. Several arborescent and semi-arborescent forms are included in the exhibit, noted under varietal names.

argenteo-variegata

atropurpurea

* *baltica*. A hardy, small-leaved variety of *H. Helix*. *baltica* from Kew. A form near *atropurpurea* with prominent crimson veins on underside of leaves.

caenwoodiana (see *pedata*)

Cathedral Ivy

Cavendishii (see *marginata*)

* *conglomerata*. Dwarf, slow-growing with crowded internodes. The varieties, or forms, known as "*erecta*," "*minima*," and "*Russelliana*" appear to be akin to *conglomerata*.

T *contracta*. This form with us is definitely not hardy.

cordata. Plants under the name "*cordata*" have been received from various sources. All appear to be referable to *H.H. deltoidea*. Plants received from two sources as "*corsica*" have been referred to *deltoidea*.

coriacea. Plants received from two sources under this name turned out to be *H. H. scutifolia*. Hibberd's "*coriacea*" is *H. colchica*.

* *crenata* (see *digitata*)

arborescent form

semi-arborescent form

dealbata. In the Brooklyn Botanic Garden this is the most attractive of a group which includes *discolor*, *Howardi*, and *marmorata elegans*—all having leaves variably mottled with white, pale yellow, or green and tinged with pink.

- * *deltoides*. A variety with stiff stems and leaves which may be heart-shaped and entire or with deep basal lobes all on the same plant. Often sold as "cordata." See fig. 4.
- * *digitata*. This variety, *crenata*, and *palmata* are practically indistinguishable when growing in pans and their growth allowed to trail along ground. When growing on tree trunks, however, *digitata* and *palmata* are very different as may be seen from the specimens shown.
- * *discolor* (see *dealbata*)
donerailensis
elegantissima (see *tricolor*)
 Emerald Green. From the Royal Botanic Gardens, Kew. We have been unable to find a description of this variety.
 Emerald Gem
- * *erecta*. An upright form of *minima*?
- T *gracilis*
 Green Feather (see Pittsburgh)
 Green Quartz (see Pittsburgh)
Hagenburgeri (see *tricolor*)
 Hahn's Miniature (see Pittsburgh)
 Hahn's Self-branching (see Pittsburgh)
helfordensis. Is similar to *donerailensis*.
- * *hibernica*. The plant commonly sold in florists' stores as English Ivy. Its leaves are larger and thinner than those of *H. Helix*.
hibernica maculata (from Kew)
 Howardi. Has mottled leaves similar to *discolor* and *dealbata*.
 Little Beauty (see Pittsburgh)
lobata major
 Long Point (see Pittsburgh)
- * *lucida*
 Manda's Crested (see Pittsburgh)
 Maple Queen (see Pittsburgh)
- T *marginata*. *Cavendishii* is considered by Nicholson to be synonymous with *marginata*, *major*.

marginata media

rubra (see *tricolor*)

Merion Beauty (see Pittsburgh)

Merion King (see Pittsburgh)

* minima (see *conglomerata*)

minor

New Bronze

* palmata (see *digitata*)

* *pedata*. We cannot distinguish mature plants of this variety from *caenwoodiana* of comparable age. Young plants may exhibit leaves with characteristic narrow-lanceolate lobes.

semi-arborescent

Pittsburgh

About twenty years ago a compact, free-branching Ivy was introduced under the name of Pittsburgh Ivy. According to Mr. Paul S. Randolph, it originated about 1915-20 in the greenhouses of the late P. S. Randolph, Verona, Pa., "as a sport of the Large Leaf Old English Ivy."¹ Pittsburgh early showed a tendency to "sport" and one at least of its sports ("Merion Beauty") in turn has produced several mutations. Forms developed from the Pittsburgh Ivy, designated as the "Ramosa Complex," have been fully described and their origin noted (when known) by Alfred Bates in the "National Horticultural Magazine," Vol. 19, No. 4, October, 1940, pp. 199-200 and Vol. 20, No. 1, January, 1941, pp. 14-20. Forms included in the Exhibit belonging in this group are as follows: Albany (Dankeri), Green Feather, Green Quartz, Hahn's Miniature, Hahn's Self-branching, Little Beauty, Long Point, Manda's Crested, Maple Queen, Merion Beauty, Merion King, Pittsburgh, Pittsburgh Variegated, Rambler, Sylvanian Beauty.

A specimen of Green Feather included in the exhibit may be seen "reverting"—probably to Pittsburgh.

* purpurea

Rambler (see Pittsburgh)

Russelliana. Described by the originator as "a noble, stronger form of preceding," which is minima. We have not had it long enough to verify the originator's claims. See *conglomerata*.

Russell's Gold

sagittifolia

* *scutifolia*

spectabilis aurea

¹ Probably *H. H. hibernica*.

submarginata — *Hedera rhombea variegata*
Sylvanian Beauty (see Pittsburgh)

T *tricolor*. Several forms such as *elegantissima*, *Hagenburgeri*, Lieb's Ivy, *marginata rubra*, seem indistinguishable from this variety, except at certain seasons.

Hedera nepalensis. Himalayas, Assam to Afghanistan and Punjab.

arborescent form

seedlings

A very distinct species with long, tapered leaves and yellow or red fruit, from the Himalayan region.

Hedera rhombea variegata

H. rhombea is a species from Japan and Korea with scaly pubescence in which the hairs have 15 to 20 rays. The fruit is black. Although we have received plants from several sources under such names as "rhombea," "rhomboidea," and "rhomboides," all have proved to be referable to other varieties. A plant received as *H. rhomboidea variegata* was determined as *H. rhombea variegata* and the plant commonly known as *submarginata* is also referable to this variety.

Also included in the Exhibit is *Fatsyhedera Lizci*, an interesting bigeneric hybrid between *Hedera Helix* and *Fatsia japonica*.

Our thanks go to the Royal Botanic Gardens, Kew, which in response to a request addressed to Sir Arthur W. Hill in June, 1939, rooted for us cuttings of 65 varieties of Ivy and shipped them early in 1940. About one-third succumbed, largely because the time occupied in transit was lengthened by disturbed world conditions. Those which survived form a valuable addition to our collection.

We offer our grateful acknowledgments to the Office of the Foreign Seed and Plant Introduction of the Bureau of Plant Industry in the United States Department of Agriculture, for living plants; and to Mrs. J. W. McGovern, whose liberal contributions of Ivy varieties in 1937 were largely instrumental in starting us on this project.

Several nursery firms have generously given us Ivy plants including: Bobbink & Atkins, Rutherford, N. J.; F. & F. Nurseries, Springfield, N. J.; Louis Hahn & Son, Pittsburgh, Pa.; and W. A. Manda, Inc., South Orange, N. J.

Mr. Alfred Bates, in addition to providing propagative material of many varieties, has always been willing to give of his time in helping to name our examples of the genus *Hedera*. He has critically read the manuscript of this "Leaflet," but the writer is responsible for any errors it may contain.

MONTAGUE FREE.

BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XXVIII BROOKLYN, N. Y., APRIL 16, 1941

No. 4-7

PUBLICATIONS
OF THE
BROOKLYN BOTANIC GARDEN
1910-1940

This check list is intended to list by title and author all the issues of the Brooklyn Botanic Garden MEMOIRS, LEAFLETS, and CONTRIBUTIONS.

The numbers of the RECORD which in themselves constitute GUIDES or other complete treatises, are also listed separately. In the case of the LEAFLETS the following abbreviations have been used for authors' names. The letters O. P. placed before an item indicate that that item, being out of print, is no longer available for distribution, except in complete sets.

B.	Ralph Curtiss Benedict	H.	Elsie Twemlow Hammond
Bi.	Guy Richard Bisby	O.	Edgar William Olive
C.	Jean A. Cross	R.	George Matthew Reed
Ch.	Margaret Chapin	Ru.	Hester Mary Rusk
Cr.	Leon Croizat	S.	Ellen Eddy Shaw
D.	Charles Francis Doney	Si.	Ray Simpson
E.	Dorothy Meigs Eidlitz	Sv.	Henry Knute Svenson
F.	Montague Free	T.	Norman Taylor
G.	C. Stuart Gager	Th.	August A. Thomen
Gr.	Arthur Harmount Graves	W.	Orland Emile White
Gu.	Alfred Gundersen		

MEMOIRS. Established, July, 1918. Published irregularly. Not offered in exchange.

Vol. I. *Dedication Papers*: 33 scientific papers presented at the dedication of the laboratory building. 1917. 521 pages. \$3.50, plus postage.

Volume II. The vegetation of Long Island. Part I. The vegetation of Montauk: A study of grassland and forest. By Norman Taylor. June 11, 1923. 108 pages. \$1.00, plus postage.

Volume III. Vegetation of Mount Desert Island, Maine, and its environment. By Barrington Moore and Norman Taylor. 1927. 151 pages. \$1.60.

Volume IV. *Twenty-fifth Anniversary Papers*. 9 papers on 25 years of progress in botany (1910-1935); 5 papers on horticulture. 1936. 133 pages. \$1.35.

CONTRIBUTIONS. Established, 1911. Papers originally published in periodicals, reissued as "separates" without change of paging. 25 numbers constitute one volume. 25 cents each, \$5.00 a volume.

- O. P. 1. The educational work of botanic gardens. C. Stuart Gager. 1911.
2. The purpose of an introductory course in botany. C. Stuart Gager. 1911.
3. Cryptomeric inheritance in *Onagra*. C. Stuart Gager. 1911.
4. On the origin and present distribution of the pine-barrens of New Jersey. Norman Taylor. 1912.
5. Ingrowing sprouts of *Solanum tuberosum*. C. Stuart Gager. 1912.
- O. P. 6. Intermingling of perennial sporophytic and gametophytic generation in *Puccinia Podophylli*, *P. obtogens* and *Uromyces Glycyrrhizae*. Edgar W. Olive. 1913.
- O. P. 7. Studies of teratological phenomena in their relation to evolution and the problems of heredity. I. A study of certain floral abnormalities in *Nicotiana* and their bearing on theories of dominance. Orland E. White. 1914.
- O. P. 8. Some observations on the formation of the capillitium and the development of *Physarella mirabilis* Peck and *Stemonitis fusca* Roth. Guy R. Bisby. 1914.
- O. P. 9. The growth forms of the flora of New York and vicinity. Norman Taylor. 1915.
- O. P. 10. Inheritance studies in *Pisum*. I. Inheritance of cotyledon color. Orland E. White. 1916.
- O. P. 11. Studies of teratological phenomena in their relation to evolution and the problems of heredity. II. The nature, causes, distribution, and inheritance of fasciation, with special reference to its occurrence in *Nicotiana*. Orland E. White. 1914.
- O. P. 12. Endemism in the flora of the vicinity of New York. Norman Taylor. 1916.
- O. P. 13. The origin of new varieties of *Nephrolepis* by orthogenetic saltation. I. Progressive variations. R. C. Benedict. 1916.
- O. P. 14. A white-cedar swamp at Merrick, Long Island, and its significance. Norman Taylor. 1916.
- O. P. 15. Present status of the problem of the effect of radium rays on plant life. C. Stuart Gager. 1916

- O. P. 16. Flora of the vicinity of New York. Norman Taylor. 1917.
- O. P. 17. Endophyllum-like rusts of Porto Rico. E. W. Olive and H. H. Whetzel. 1917.
- O. P. 18. Inheritance of endosperm color in maize. Orland E. White. 1917.
- O. P. 19. Inheritance studies in Pisum. II. The present state of knowledge of heredity and variation in peas. Orland E. White. 1917.
- O. P. 20. Inheritance studies in Pisum. III. The inheritance of height in peas. Orland E. White. 1918.
21. A sketch of plant classification from Theophrastus to the present. Alfred Gundersen. 1918.
22. A basis for reconstructing botanical education. C. Stuart Gager. 1919.
- O. P. 23. Plant families: A plea for an international sequence. Alfred Gundersen. 1920.
- O. P. 24. Plants and animals of Mt. Marcy, New York. Charles C. Adams, George P. Burns, T. L. Hankinson, Barrington Moore, and Norman Taylor. 1920.
- O. P. 25. Endemism in the Bahama flora. Norman Taylor. 1921.
- O. P. 26. Plant composition and soil acidity of a Maine bog. Barrington Moore and Norman Taylor. 1922.
27. The origin of new varieties of *Nephrolepis* by orthogenetic saltation. II. Regressive variation or reversion from the primary and secondary sports of *Bostoniensis*. R. C. Benedict. 1922.
- O. P. 28. Botanical exploration in Bolivia. Orland E. White. 1922.
29. Anthracnose of the Boston fern. James A. Faris. 1923.
30. Varietal resistance and susceptibility of sorghums to *Sphacelotheca Sorghi* (Link) Clinton and *Sphacelotheca cruenta* (Kühn) Potter. George M. Reed. 1923.
31. The Melanconis disease of the butternut (*Juglans cinerea* L.). Arthur Harmount Graves. 1923.
32. New bud sports in *Nephrolepis*. R. C. Benedict. 1923.
33. Sorghum smuts and varietal resistance in sorghums. George M. Reed and Leo E. Melchers. 1925.
34. Varietal susceptibility of oats to loose and covered smuts. George M. Reed. 1925.

35. Factors influencing infection of *Hordeum sativum* by *Ustilago hordei*. James A. Faris. 1924.
36. Influence of environal factors on the infection of sorghums and oats by smuts. I. Experiments with covered and loose kernel smuts of sorghum. George M. Reed and James A. Faris. 1924.
37. Influence of environal factors on the infection of sorghums and oats by smuts. II. Experiments with covered smuts of oats and general considerations. George M. Reed and James A. Faris. 1924.
38. Physiologic races of oat smuts. George M. Reed. 1924.
39. Relative susceptibility of selections from a Fulghum-Swedish Select cross to the smuts of oats. George M. Reed and T. R. Stanton. 1925.
40. Physiological specialization of *Ustilago hordei*. James A. Faris. 1924.
41. Factors influencing the infection of wheat by *Tilletia Triticici* and *Tilletia laevis*. James A. Faris. 1924.
42. Variation among the sporelings of a fertile sport of the Boston fern. Ralph C. Benedict. 1924.
43. Inheritance studies in *Pisum*. V. The inheritance of scimitar pod. Orland E. White. 1925.
44. Modes of infection of sorghums by loose kernel smut. James A. Faris and George M. Reed. 1925.
45. The inheritance of resistance of oat hybrids to loose smut. George M. Reed. 1925.
46. Geographical distribution and the cold-resisting character of certain herbaceous perennial and woody plant groups. Orland E. White. 1926.
47. The cause of the persistent development of basal shoots from blighted chestnut trees. Arthur Harmouat Graves. 1926.
48. Further evidence of physiologic races of oat smuts. George M. Reed. 1927.
49. Chromosome and gene mutations in *Datura* following exposure to radium rays. C. Stuart Gager and A. F. Blakeslee. 1927.
50. The climate of Long Island. Its relation to forests, crops and man. Norman Taylor. 1927.
51. Experimental studies on head smut of corn and sorghum. George M. Reed, Marjorie Swabey, and Laura Alma Kolk. 1927.

52. Inheritance studies in *Pisum*. VI. Multiple allelomorphism and the inheritance of green and yellow foliage and pod color. Dorothy I. Neff and Orland E. White. 1927.
53. Mutation, adaptation to temperature differences, and geographical distribution in plants. Orland E. White. 1928.
54. The vegetation of the Allegany State Park. Norman Taylor. 1928.
- O. P. 55. Physiologic races of bunt of wheat. George M. Reed. 1928.
- O. P. 56. The inheritance of resistance of oat hybrids to loose and covered smut. George M. Reed. 1928.
57. New physiologic races of the oat smuts. George M. Reed. 1930.
58. A new method of producing and detecting sorghum hybrids. George M. Reed. 1930.
59. Hybrids of *Iris fulva* and *Iris foliosa*. George M. Reed. 1931.
60. The iris of Japan. George M. Reed. 1931.
61. Inheritance of smut resistance in hybrids of Early Gothland and Monarch oats. George M. Reed. 1931.
62. Physiologic races of *Ustilago levis* and *U. avenae* on red oats. George M. Reed and T. R. Stanton. 1932.
63. Inheritance of resistance to loose and covered smut in a hybrid of Early Gothland and Victor oats. George M. Reed. 1932.
64. Inheritance of resistance to loose and covered smut in hybrids of Hull-less with Early Gothland and Monarch oats. George M. Reed. 1932.
65. Monographic studies in the genus *Eleocharis*. II. H. K. Svenson. 1932.
- O. P. 66. Inheritance of resistance to loose and covered smut in hybrids of Black Mesdag with Hull-less, Silvermine, and Early Champion oats. George M. Reed. 1934.
67. Inheritance of resistance to loose smut and covered smut in some oat hybrids. T. R. Stanton, George M. Reed, and F. A. Coffman. 1934.
68. Monographic studies in *Eleocharis*. III. H. K. Svenson. 1934.
69. Plants of the Astor Expedition, 1930 (Galapagos and Cocos Islands). H. K. Svenson. 1935.

70. Inheritance of resistance to loose smut in hybrids of Fulghum and Black Mesdag oats. George M. Reed. 1935.
71. Physiologic specialization of the parasitic fungi. George M. Reed. 1935.
72. Reaction of oat varieties to physiologic races of loose and covered smuts of red oats. George M. Reed and T. R. Stanton. 1936.
73. Studies of the root nodule organisms of certain wild legumes. Marie Eckhardt Conklin. 1936.
74. The effects of radium rays on plants. C. Stuart Gager. 1936.
75. Inheritance of resistance to the loose and covered kernel smuts of sorghum. I. Dwarf Yellow Milo hybrids. D. Elizabeth Marcy. 1937.
76. Inheritance of resistance to the loose and covered kernel smuts of sorghum. II. Feterita hybrids. D. Elizabeth Marcy. 1937.
77. Monographic studies in the genus *Eleocharis*. IV. H. K. Svenson. 1937.
78. Experiments on latent infection of resistant varieties by the loose and covered smut of oats. Paul F. Brandwein. 1937.
79. The iris thrips and its control by hot water, with notes on other treatments. Floyd F. Smith and L. G. Utter. 1937.
80. Inheritance of resistance to loose and covered smuts in Markton oat hybrids. George M. Reed and T. R. Stanton. 1938.
81. Inheritance of resistance to loose and covered smuts in oat hybrids. George M. Reed and T. R. Stanton. 1937.
82. Culture and inoculation studies on races of the loose and covered smuts of oats. L. Gordon Utter. 1938.
83. Pteridophyta of the Galapagos and Cocos Islands. H. K. Svenson. 1938.
84. Influence of the growth of the host on oat smut development. George M. Reed. 1938.
85. Monographic studies in the genus *Eleocharis*. V. H. K. Svenson. 1939.
86. The emergence of smut-inoculated oat seedlings through sand and loam soil. Paul F. Brandwein. 1938.

87. Flower buds and phylogeny of Dicotyledons. Alfred Gunderson. 1939.
88. The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 37. The Cyperaceae. H. K. Svenson. 1939.
89. Plants of Southern United States: I. *Viburnum dentatum* L. II. *Satureja glabella* (Michx.) Briquet. III. Woody Species of *Hypericum*. H. K. Svenson. 1940.
90. Physiologic Races of Oat Smuts. George M. Reed. 1940.
91. Infection studies on the covered smut of oats. Paul Brandwein. 1940.
92. Breeding work toward the development of a timber type of blight-resistant chestnut. Report for 1939. Arthur Harmount Graves. 1940.

RECORD. Established, January, 1912. An administrative periodical issued quarterly (1912-1928); bimonthly (1929-1932); quarterly (1933-). Contains, among other things, the Annual Report of the director and heads of departments, special reports, educational Prospectus, Seed List, Guides. \$1.00 a year. Guide numbers specially priced, as listed below:

The following numbers of the RECORD are out of print. Volume 1 No. 1 and 2; V. 3 No. 1, 2, 3, 4; V. 4, No. 1; V. 6, No. 1, 2; V. 8, No. 2; V. 9, No. 2, 3, 4; V. 10, No. 1; V 12, No. 8; V. 13, No. 2; V. 16, No. 3; V. 17, No. 2, 3; V. 18, No. 2, 3, 4; V. 19, No. 4; V. 20, No. 5;

The following numbers of the RECORD deal with special topics as listed:

O. P. Vol. 16, No. 3. July, 1927. Research at the Brooklyn Botanic Garden, 1910-1927. 46p. 25 cents.

O. P. Vol. 17, No. 3. July, 1928. Facts about the Brooklyn Botanic Garden. 17p. 10 cents.

O. P. Vol. 18, No. 4. July, 1929. Public education at the Brooklyn Botanic Garden. 76p. 25 cents.

Vol. 21, No. 6. November, 1932. Legal documents and information bearing on the establishment, organization, and activities of the the Brooklyn Botanic Garden, 1897-1932. 60p. 25 cents.

Vol. 22, No. 3. July, 1933. (Plant forms in ornament number.) 14 p. 10 cents.

Vol. 24, No. 3. July, 1935. Books and manuscripts illustrating the history of botany, an annotated list. 36 p. 25 cents.

Vol. 25, No. 3. July, 1936. The early vegetation of Long Island. H. K. Svenson. 22 p. 10 cents.

- O. P. Vol. 26, No. 3. July, 1937. Botanic gardens of the world; materials for a history. C. Stuart Gager. 205p.
Vol. 27, No. 3. July, 1938. Botanic gardens of the world; materials for a history. 2d-ed. C. Stuart Gager. 256p. \$2.50.

GUIDES

- O. P. Guide No. 1. The Brooklyn Botanic Garden. (Popular Science Monthly. Apr. 1912. p. 338-345).
- O. P. Guide No. 2. Gardens within a garden: A general guide to the grounds of the Brooklyn Botanic Garden. (Record v. 18, p. 153-188, May 1929). Price, 25 cents.
Guide No. 3. The story of our metate: A chronicle of corn. (Record v. 18, p. 283-307, Nov. 1929). Price, 25 cents.
- O. P. Guide No. 4. The Japanese Garden. (Record v. 19, p. 197-234, July, 1930). Price, 25 cents.
Guide No. 5. The Rock Garden. 28 illustrations. (Record v. 20, p. 187-241, May, 1931) Price, 35 cents. By mail, 40 cents.
Guide No. 6. Japanese potted trees (Hachinoki). 11 illustrations. (Record v. 20, p. 279-289, Nov. 1931). Price, 35 cents. By mail, 40 cents.
Guide No. 7. The story of our boulders: Glacial geology of the Brooklyn Botanic Garden. 22 illustrations. (Record v. 21, p. 165-207, May, 1932). Price, 35 cents. By mail, 40 cents.
Guide No. 8. The story of fossil plants. (Record v. 27, p. 209-237, July, 1932) 8 illustrations. Price, 35 cents. By mail, 40 cents.
Guide No. 9. The Rose Garden of the Brooklyn Botanic Garden. 12 illustrations, folded map. (Record v. 28, p. 159-215, July, 1939). Price, 50 cents.
Guide No. 10. Gardens within a garden: A general guide to the grounds of the Brooklyn Botanic Garden. Second Edition. 57 pages; 21 illustrations. Folded map. (Record v. 29, p. 157-213, July, 1940). Price, 25 cents. By mail, 30 cents.
Guide No. 11. List of shrubs exclusive of conifers growing outdoors in the Brooklyn Botanic Garden. (Record v. 30, p. 1-32, Jan. 1941). Price, 25 cents. By mail 30 cents.

ANNUAL REPORTS

The second number of each volume of the RECORD constitutes the Annual Report. E. g. the 29th report, for 1939, was issued as RECORD v. 29, no. 2, April, 1940.

LEAFLETS. Established, April 10, 1913. Published weekly or biweekly during April, May, June, September, and October. Infrequent since 1936. Contain popular, elementary information about plant life for teachers and others; also announcements concerning flowering and other plant activities to be seen in the Garden near the date of issue. Free to members of the Garden. To others, fifty cents a series. Single numbers 5 cents each.

Double numbers (e. g. no. 1-2, 5-6, etc. 10 cents)

Triple numbers (e. g. no. 1-3, 5-7, etc. 15 cents)

SERIES I, 1913

- O. P. 1. Foreword. G; Some plants flowering early in April. T.
2. The opening of buds. G.
3. Kinds and position of buds. O; Some native wild flowers now in bloom. T.
4. Some plants flowering early in May. T.
5. The pollination of pines. G; Plants now in bloom. T.
6. Plants flowering in the last half of May. T.
7. The leaves of pines and other conifers. O.
- O. P. 8. The work of green leaves. O; Plants now blooming. T.
- O. P. 9. Respiration in plants. O; Shrubs now in bloom. T.
- O. P. 10. Some interesting varieties of corn growing in the Garden. W.
- O. P. 11. Our native shrubs and what may be done with them. T.
- O. P. 12. Bulb culture. S.
- O. P. 13. Kinds and characteristics of bulbs. S.
14. Leaf fall. G.

SERIES II, 1914

- O. P. 1. Backyard gardens. S.
- O. P. 2. The wild flower garden. S.
- O. P. 3. Tree Planting. S. and G.
- O. P. 4. Ornamental climbers. F.
- O. P. 5. Information for teachers about the Brooklyn Botanic Garden Plants now in bloom. T.
6. Children's Garden Exhibit. S.
- O. P. 7. Vandalism turned to account. G.
- O. P. 8. Heredity, variation and environment. W.
- O. P. 9. Hedge plants. F.

- O. P. 10. Window boxes. S.
11. The potato industry of northern Maine and its relation to that of Long Island. Bi.
 12. The history of *Nicotiana* II: An account of the heredity and environment of a family of tobacco plants. W.
- O.P.13-14. Grafts, grafting and graft-hybrids. W.

SERIES III, 1915

- O. P. 1. List of talks for elementary school classes. S.
2. The second annual children's garden exhibit. S.
 3. Plants for hanging baskets. F.
 4. The nature of plant diseases. O.
 5. A walk through the Garden. T.
 6. The origin and history of some of our more common garden vegetables. W.
 7. The children's garden exhibit. S.
- O. P. 8. The Boston fern and some of its varieties. B.
9. Talks for elementary school classes. S.
 - 10-11. The crossing of flowers. W.
- O. P. 12. House plants. F.; Plants now in fruit in the economic house.

SERIES IV, 1916

- O. P. 1. List of talks for elementary school classes. S.
2. The third annual garden exhibit for Brooklyn boys and girls. S.
 3. Ten common trees of Brooklyn. Gu.
 4. The wild flower garden in May. Gu.
 5. The Japanese Garden. G.
 6. Poison ivy. Bi.
 7. The Brooklyn Botanic Garden boys' and girls' clubs.
 8. Field trips for the study of variation and evolution. W.
 9. Variation, environment and the laws of heredity. W.
- O. P. 10. Bulb culture. (Reprint of Series I, No. 12) S.
11. The origin and history of our more common cultivated fruits. W.
 12. Talks for elementary school classes. S.

- O. P. 13. Some early botanists. Gu.
O. P. 14. The ancient history of plants. W.

SERIES V, 1917

- O. P. 1. Summer courses for teachers of gardening.
2. List of talks for elementary school classes. S.
3. Guide to the laboratory building. G.
4. The small vegetable garden. F.
5. Fourth annual garden exhibit for Brooklyn boys and girls. C.
6. Some insect pests. F.
7. The wild flower garden in June. Gu; A new trophy needed. G.
8. The storage of vegetables. F; Plants now in bloom. T.
9. The one-period cold-pack method of canning.
10. Talks for elementary schools. S.
11. Fall treatment of land for garden crops. F.
12-13. Forest problems of the Ashokan Watershed. G; Plants of the Catskill Aqueduct region. T.
14. Autumn Colors. O.

SERIES VI, 1918

1. The small vegetable garden. F.
2. Environment, variation, and the laws of heredity. W.
3. Our common garden vegetables—their history and their origin. W.
4. Potato Diseases. O.
5. Fifth annual garden exhibit for Brooklyn boys and girls. S.
6. Co-operation of the Brooklyn Botanic Garden with the elementary schools. S.
7. Children's garden work plus the dollar sign—how the war affects children's gardening. S.
8. Fertilizers for city gardens. F.

SERIES VII, 1919

- O. P. 1. Making a lawn. F.
2. The sixth annual garden exhibit for Brooklyn boys and girls. S.

3. The rock garden. F.
- O. P. 4. Flowers of the rock garden. F.
- O. P. 5. Key to some of the principal families of flowering plants. O.
6. The single-period cold-pack canning of fruits and vegetables.
7. Trees of Prospect Park and Brooklyn Botanic Garden. Gu.
8. The living soil. O.
9. Some Brooklyn weeds. Gu.
- 10-11. The garden of hardy plants. F.
- 12-13. A brief guide to the Conservatories. T.

SERIES VIII, 1920

1. Real Tests. S.
2. The seventh annual garden exhibit for Brooklyn boys and girls. S.
- 3-5. The ancient history of plants. W.
- 6-8. The Brooklyn Botanic Garden collection of portraits of botanists. G. and. Gu.
- O. P. 9. Care of the lawn. F.
10. Families of useful plants. Ch.

SERIES IX, 1921

1. Spring lectures at the Brooklyn Botanic Garden.
2. Eighth annual garden exhibit for Brooklyn boys and girls. S.
- 3-4. The pollination of flowers. W.
5. Time and sundials. Gu.
6. John Burroughs: teacher, poet and naturalist. W.
- O. P. 7. House plants. F.
8. The collection of water lilies at the Brooklyn Botanic Garden. Gr.
9. Plant immigrants and natives: a comparison. T.
10. Educational projects. S.

SERIES X, 1922

1. Arbor Day. Gr.

2. Ninth annual garden exhibit for Brooklyn boys and girls. S.
- O. P. 3. Evolution as illustrated by ferns. B.
4. Brazil nuts. W.
- O. P. 5. The Wardian case: a device for growing plants in the schoolroom or livingroom. H.
6. The evolution group at the Brooklyn Botanic Garden. G.
7. Bulb culture. S; The Garden collection of perennial asters. Gr.
8. The forests and some big trees of Long Island. T.
- O.P.9-10. Ferns as house plants. B.

SERIES XI, 1923

1. Gregor Mendel, pioneer investigator of the laws of heredity. W.
2. Tenth annual garden exhibit for Brooklyn boys and girls. S.
- 3-4. Louis Pasteur (1822-1895). R.
- O. P. 5. Wild plant conservation in Connecticut, a suburban state. B.
6. The rock garden. F.
7. Some September flowers at the Garden. Gr.
8. El Monte. W.
9. Evolution in flowering plants. Gu.
10. Ten years of work in elementary education at the Brooklyn Botanic Garden. S.

SERIES XII, 1924

1. Eleventh annual garden exhibit for Brooklyn boys and girls. S.
- O. P. 2. The conservation of beauty. B.
3. Flowers of the rock garden. F.
- O. P. 4. Families of dicotyledons. Gu.
- 5-6. Irises. R.
7. The lotus. Gr.
- 8-9. Trees of the Brooklyn Botanic Garden and Prospect Park. Gu.

10. Some common horticultural questions. I. When and how to transplant trees and shrubs; winter care of dahlias and cannas. Gr.

SERIES XIII, 1925

- 1-3. Sorghum. R.
4. Twelfth annual garden exhibit for Brooklyn boys and girls. S.
- O.P. 5-6. The conservation of beauty. B.
- O.P. 7-9. A preliminary list of native and naturalized woody plants of Greater New York. Gr.
10. Some questions relating to the classification of flowering plants. Gu.

SERIES XIV, 1926

- O. P. 1. House plants. F.
2. "Naturalized" bulbs. F.
- 3-6. Environment, variation and the laws of heredity. W.
- 7-8. The ways of plants. W.
- O.P.9-10. Forms and functions of leaves. Gr.

SERIES XV, 1927

1. Epiphytes and house plants. F.
- O.P. 2-3. The Wardian case. H.
4. Families of vascular plants (except dicotyledons). Gu.
- 5-7. Exhibit of living plants and other material illustrating various phases of research at the Brooklyn Botanic Garden.
- 8-10. Our common garden vegetables: their history and their origin. W.
- 11-12. What price Christmas greens? Gr. (This leaflet was bered 10-12 in error.)

SERIES XVI, 1928

1. The story of plant evolution. Gu.
- 2-3. How bacteria are studied in high school science classes. B.
4. How shall we save rare plant species from extinction? B.
- 5-7. Department of Elementary Instruction: A survey of work from 1913 to 1928. S.

- 8-9. Bulb culture. S; Hardy chrysanthemums. F.
- 10-11. Practical suggestions for the growing of Christmas greens. Gr.

SERIES XVII, 1929

- 1-3. A selected list of publications on gardening and wild flowers. Si.
- 4-5. Bird life at the Brooklyn Botanic Garden. H.
- O.P. 6-7. Evolution as illustrated by ferns. B.
- 8-12. Forms and functions of stems. Gr.

SERIES XVIII, 1930

- 1-2. Spring planting. F.
- 3. Fertilizers for city gardens. F.
- 4. The principal groups of fossil plants. Gu.
- O. P. 5. The plant wards of New York State. B.
- 6. The Rose Garden of the Brooklyn Botanic Garden. F.
- 7-8. Cabbages in the classroom. B.
- 9-10. Forms and functions of roots. Gr.

SERIES XIX, 1931

- 1. House plants. F.
- 2-3. Important woody plants—trees, shrubs, and woody climbers—of Greater New York. Gr.
- 4-5. Important herbaceous plants of the Greater New York region. Sv.
- 6. November in your garden. F.
- 7-9. Forms and functions of leaves. Gr.
- 10. December in your garden. F.

SERIES XX, 1932

- 1. March in your garden. F.
- 2. April in your garden. F.
- 3. May in your garden. F.
- 4. The genus *Prunus* (cherries, plums, etc.) in the Brooklyn Botanic Garden. Gu. and D.
- 5. June and July in your garden. F.
- 6. October in your garden. F.

SERIES XXI, 1933

- 1. Exhibit of the methods of plant propagation at the 20th Annual Flower Show. F.

2-6. Methods of plant propagation. F.

7-8. Hay Fever. Th.

SERIES XXII, 1934

1-2. The collection of living Cycads at the Brooklyn Botanic Garden. Gr. and Gu.

3-4. Pruning ornamental trees and shrubs. F.

5. The exhibits of Brooklyn Botanic Garden at 21st International Flower Show. F.

6. Planting and cultivation of annuals. F.

7. Starting perennials from seeds. F.

8-9. Autumn coloration. Gr.; Care of house plants. F.

SERIES XXIII, 1935

1. The Brooklyn Botanic Garden exhibit of garden operations at the 22nd International Flower Show. F.

2-3. The care of cut flowers. Gr.

4. Preparation of herbarium specimens. Sv.

5. Characteristics of families of dicotyledons except sympetalae. Gu.

SERIES XXIV, 1936

1. The Brooklyn Botanic Garden exhibit of rock garden plants. F.

2. Japanese gardens and their influence. E.

3-5. Rare trees and shrubs of Kissena Park. Cr.

6. The terrarium. H.

NOTE: No Leaflets were printed in 1937.

SERIES XXV, 1938

1. The Brooklyn Botanic Garden exhibit of a knot garden with herbs. F.

2-4. The herb garden of the Brooklyn Botanic Garden. F. G. and Gr.

SERIES XXVI, 1939

1-2. The Brooklyn Botanic Garden exhibit of house plants. F.

SERIES XXVII, 1940

1-2. Carnivorous plants. Sv. and F.

3. The care of cut flowers. Gr. and Ru.

WILLIAM E. JORDAN.

N A T I O N A L

VICTORY
GARDEN

P R O G R A M

OF

BROOKLYN BOTANIC GARDEN

Brooklyn Botanic Garden Leaflets

Series XXIX Brooklyn, N. Y., February 18, 1942 No. 1-2

NATIONAL VICTORY GARDEN PROGRAM

1942

In this LEAFLET the Brooklyn Botanic Garden sets forth what it is prepared to do in the present national emergency. The plans outlined here have been approved by the Brooklyn Office of Civilian Defense (O. C. D.).

Gardening is a valuable recreation in that it definitely improves the mental and physical health of those engaged in it. The Government does not advocate digging up lawns for the purpose of raising vegetables to increase the food supply. Present indications are that there is and will be a sufficient supply for all. The Brooklyn Botanic Garden is offering gardening as a means to the maintenance of a healthy public morale, and, therefore, an appropriate part of civilian defense. Because many Botanic Garden members and others have country places where vegetables can be grown successfully, the Botanic Garden, in the courses described below, is devoting some attention to vegetable gardening.

There is a shortage of seeds of certain crops—drugs, herbs, and vegetables. In view of this scarcity it can readily be seen that it is essential that the seeds which are in short supply should be handled only by those who have the knowledge and the facilities for getting the best results from them. There must be no waste of seeds, fertilizers, or effort. We must conserve our energies and supplies for total victory.

VICTORY GARDEN MEETING

A special meeting will be held at the Brooklyn Botanic Garden on Thursday, February 19, at 3:30 p. m. This meeting will have as its object an explanation and discussion of the Victory Garden Movement. *This meeting is open free to the public.*

VICTORY GARDEN COURSES

Special Victory Garden Courses have been planned and will be announced at the above Meeting. These are as follows:

1. *Victory Garden Course* (A48) No fee. 5 Mondays: March 9th to April 6th, at 11:00 a. m. Lectures and demonstrations on how to start and maintain a Victory Garden of flowers and vegetables.

Mr. Montague Free, Miss Margaret M. Dorward.

2. *Victory Greenhouse and Lecture Course* (A49). 5 Thurs-

days: March 26th to April 23rd, at 11:00 a.m. Same as above with the addition of practical work in the greenhouses, where seedlings will be grown. Laboratory fee \$3.

Mr. Free and Miss Dorward.

Regular Brooklyn Botanic Garden Courses starting at this time of the year are as follows: (these courses will be modified to conform to the theme of the Victory Garden Movement.)

1. *Fundamentals of Gardening* (A25). 5 Wednesdays: February 25th to April 1st (omitting March 18th.), at 10:30 a.m. Fee \$8 to non-members of the Botanic Garden; \$3 to members. Class limited to 45. An opportunity to start, in the greenhouse, your own plants for the next summer's garden. Lessons include the following:

Sowing seeds and pricking out seedlings in the greenhouse.

The small vegetable garden.

How to maintain good garden soil.

Practical outdoor garden work demonstrated.

Plants raised become the property of the class members.

Miss Ellen Eddy Shaw and

Miss Margaret M. Dorward.

2. *Spring Garden Work* (A26). For those who have completed A25. 6 Tuesdays: March 3rd to April 14th (omitting March 17th), 10:00 a.m.* Fee \$8 to non-members of the Botanic Garden; \$3 to members. Enrolment limited to 45. Starting the newer annuals and perennials from seed. Lectures on the herbaceous border, trees and shrubs, and the lawn will be given. Miss Michalena L. Carroll of the Garden staff will give a lecture on "Color in the Garden."

Miss Dorward.

3. *Garden Practice* (B5). Tuesdays, 4:00 p.m., beginning March 3rd. Offered as Nature-Garden Science, in co-operation with the Board of Education. Laboratory fee \$2. Includes nature study in its relation to School Gardening as well as practical and theoretical work in the organization of Children's Gardens.

A teacher's alertness course for which 2 credits are allowed on completion.

Mr. Marvin M. Brooks, Director of Nature Garden Work of New York City Schools, Miss Shaw, and Miss Miner.

4. *The Kitchen Garden* (A47). Tuesdays, 11:30 a.m.* March

* These hours are slightly different from those announced in the *Prospectus*. They have been arranged by request, so that a person may take *both* the Tuesday morning courses (2 and 4).

24th to April 28th. Six lessons on the culture of vegetables and culinary herbs. Enrolment limited to 45. Fee, to non-members of the Garden, \$6 (including laboratory fee); to members of the Garden, \$1 laboratory fee. Planning the garden, companion cropping and "follow-up" crops. Preparing and fertilizing soil. Sowing seeds, thinning, cultivating, harvesting, and storing. The members of the class have the privilege of keeping the plants they have raised.

Mr. Free.

Please Note. No person may take more than 2 courses at once, which involve greenhouse work. In order to be eligible for "Spring Garden Work" one must first have completed "Fundamentals of Gardening." Reservations for courses must be accompanied by the fee, except for the Free Victory Garden Course.

Lectures are being arranged which will be held in the auditorium of the Brooklyn Office of Civilian Defense at 136 Livingston Street. Announcements will be made in due season in the public press.

DEMONSTRATION FLOWER AND VEGETABLE GARDEN

From early spring until late fall a model flower and vegetable garden, located in the Children's Gardens at the southwest part of the Botanic Garden, will be on view. In cooperation with the health program which is being sponsored by many of the federal, state, and garden club organizations, the vegetables in this demonstration plot will be labelled as to their important mineral and vitamin content.

ASSISTANCE TO THE SCHOOLS

In response to a request from the New York City Board of Education, courses are being given at the Garden to prepare teachers for garden work with children.

The Board of Education of New York City has prohibited the visiting of museums and botanic gardens by classes from the schools. Therefore, the Botanic Garden is planning special educational work at the schools themselves, and illustrated lectures on the subjects of gardening and economic plants are being given at the schools by appointment.

Following are the subjects offered to Brooklyn Elementary and Junior High Schools, to be given at the schools by appointment.

MARCH 2 TO JUNE 15, 1942

GRADE III.

1. Spring Wild Flowers
2. Plants Important to the American Indians

GRADE IV.

1. Food Plants of China
2. Fruits in New York City Markets

GRADE V.

1. Wheat, Corn, Oats, Rye, and Barley
2. Trees of the Northwest—Their Economic Value

GRADE VI.

1. Plant Products of Brazil
2. Fiber Plants—Cotton, Linen, Jute, Sisal, Manila Hemp

JUNIOR HIGH SCHOOL

1. Soil and Forest Conservation
2. Plants without Flowers—Ferns, Mosses, and Fungi
(*Given to small groups only*)

GARDEN TALKS AND DEMONSTRATIONS

(*Given singly, or as a series, with one lecture a week*)

1. How to Make a Garden (soil, tools, fertilizers)
2. Flowers and Vegetables for Victory Gardens (garden plans)
3. The Work of the Plant—Root, Stem, Leaf (experiments; for one class only)
4. Garden Operations—Planting, Thinning, Weeding, etc.

FOR MOTHERS' CLUBS AND PARENTS' ASSOCIATIONS

(*For Groups of twenty-five or more*)

Victory Gardens for Young and Old

For High Schools (Science Clubs or Classes) and Colleges the following illustrated lectures may be arranged for at the School or College.

1. Wild flowers (spring, summer, fall)
2. Familiar ferns
3. Our common broad-leaved trees
4. Our common evergreen trees
5. Seaweeds (for small classes: illustrated by specimens only; no slides)
6. Common food plants of the tropical zone
7. Common food plants of the temperate zone
8. Mushrooms and toadstools
9. Plant diseases
10. Plant propagation
11. Reproduction in plants
12. Variation and evolution in plants
13. Plant breeding
14. Breeding disease-resistant chestnut trees
15. Conservation of plants—including forestry
16. Soil conservation

Appointments should be made at least one week in advance. For Elementary and Junior High Schools, arrangements should be made with the *Curator of Elementary Instruction*; for High Schools and Colleges, with the *Curator of Public Instruction*. Address: Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, N. Y. Telephone MAin 2-4433.

OTHER ACTIVITIES

A Bureau of Garden Information has been arranged to answer inquiries on garden work. Telephone: MAin 2-4433.

Assistance to Garden Clubs. Lectures and demonstrations are being given to Garden Clubs. One lecture on Victory Gardens will be given free of charge to any Brooklyn Garden Club where and audience of 25 or more is assured. Other clubs of 20 or more

members may meet at the Botanic Garden for similar lectures and demonstrations.

Books on Gardening are being placed on the open shelves in the Botanic Garden Library which is open free to the public, daily from 9 to 5, Saturdays, 9 to 12.

BROADCASTS

Broadcasts given by members of the staff of the Garden have been scheduled for the first half of the year as follows: (Station WNYC. Fridays, 3:30 p. m.)

- January 30.—*Planning Your Garden.* Miss Eddy Shaw,
Curator of Elementary Instruction
- February 13.—*Good Hedge Plants.* Mr. Charles F. Doney,
Assistant in Woody Plants
- February 27.—*New Healing Agents from Plant Sources.*
Dr. Ralph H. Cheney, Resident Investigator (Economic Plants); Professor of Biology, Long Island University
- March 13.—*It Is Time to Start the Children's Garden.*
Miss Frances Miner, Instructor
- March 27.—*What Are Biennials?* Miss Elizabeth
Clarke, Curatorial Assistant
- April 10.—*Bacteria: Friend and Foe.* Dr. L. Gordon
Utter, Research Assistant
- April 24.—*Some Native Shrubs.* Miss G. Elizabeth
Ashwell, Curatorial Assistant
- May 1.—*Maples Around the World.* Dr. Alfred
Gundersen, Curator of Plants
- May 15.—*Edible Wild Plants.* Miss Hester M. Rusk,
Instructor
- May 29.—*Folk Lore of Plants.* Dr. Arthur Harmount
Graves, Curator of Public Instruction
- June 12.—*Water Lilies for Your Garden.* Mr. George
R. Bishop, Foreman Gardener
- June 26.—*The Story of the Dahlia.* Mr. Montague
Free, Horticulturist

NOTICES

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The Street entrance to the Laboratory Building is at 1000 Washington Avenue, between Eastern Parkway and Empire Boulevard and opposite Crown Street.

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BROOKLYN BOTANIC GARDEN
LEAFLETS

SERIES XXIX

BROOKLYN, N. Y., MARCH 18, 1942

No. 3-4

THE BROOKLYN BOTANIC GARDEN EXHIBIT
of
THE ART OF GRAFTAGE
INTERNATIONAL FLOWER SHOW
MARCH 16TH TO 21ST, 1942

Budding, grafting, or graftage are the terms used to describe the operation of placing, or inserting, a portion of one plant (bud or scion) upon another plant (the stock) so that they grow together.

Graftage is an ancient art, known to horticulturists at least two centuries B. C. The early writers on the subject had notions concerning it which seem startling to us with our more exact knowledge of its possibilities and limitations. Virgil, freely translated, says: "The rough strawberry-tree is grafted even with the young shoot of the nut. Unfruitful planes sound apples bear. The beech is white with flowers of chestnut; and ash blows white with flowers of pear; while under the elms, the swine are crunching the acorns." Pliny makes the astonishing statement that: "Some apples are just the color of blood, owing to an original graft of the mulberry."

If we could believe that these old writers were referring to actualities and not indulging in a form of poetic license it would be necessary to admit that our remote ancestors were better horticultural craftsmen than we are today. Although it has been reported in modern times that successful graft unions have been performed between plants in such distantly related families as Cichoriaceae and Euphorbiaceae, in general, it is the current opinion that there must be close botanical affinity between stock and scion to secure a successful union, and the grafting of apple to plane, and pear to ash is beyond the skill of present day gardeners. While it is possible to graft such diverse species as: chestnut on oak, lilac on privet, pear on quince, etc., usually a more permanent union is effected when the graft is made within the genus, and the chances of success are increased if the same or a closely related species is used as an understock.

The ancients, however, did know about grafting, and good advice is given concerning the place of incision and the selection of the scions. And it is interesting to note that some of their practices have persisted to modern times. For example, according to Pliny,

Cato (born 234 B. C.) recommended, for covering the graft, a "mixture of argil or powdered chalk, and cow dung, to be stirred together till it is of a viscous consistency, and then inserted in the fissure and rubbed all around it." While grafting wax is in general use now as a dressing for wounds made in grafting I can remember as a boy seeing newly inserted cleft-grafts almost completely hidden with a plaster of clay and cow dung; and I would not be at all surprised if the practice still persists.

Pliny thinks that the art of grafting was suggested by the sight of "cherry growing upon willow" and so forth, occurring as a result of the dropping of seeds by birds. These happenings of course do not represent true grafts, but are seedlings rooted in debris lodged in the tree, or in the decaying wood of a trunk partially hollowed. Natural grafting, however, does occasionally occur, and it is illustrated in this exhibit by a specimen of *Crataegus* where two branches have become united without artificial aid. It is not inconceivable that branches of different, but related, trees growing in proximity, might grow across each other, become abraded as a result of the action of wind, and form a natural graft union—a phenomenon which could not fail to be suggestive to an observant husbandman.

There are many different reasons why graftage is practiced by horticulturists. Its chief use is in the propagation of plants which, because of their mixed ancestry, do not come true from seeds and which do not readily or quickly root from cuttings. Most of our fruit trees are in this group. Apples are budded or grafted on seedling apple understocks, on young plants of special stocks propagated by layering, or on pieces of roots of older trees; peaches are usually budded on seedlings of the "wild" peach; pears are budded on pear seedlings, or on quince stocks obtained from cuttings or layers, and so on.

Sometimes graftage is employed to modify the growth of the scion, as when apples are worked on understocks of varieties of apple known to have a dwarfing influence. These understocks, which are propagated asexually, have been studied extensively by agricultural experiment stations in recent years. Through the courtesy of the Geneva (N. Y.) Agricultural Experiment Station we are able to exhibit specimens showing variation in growth as a result of grafting the Baldwin apple upon three of the many varieties of understock originally selected and named by the East Malling Research Station of England. Pears are grafted on quince for the purpose of dwarfing them—an example of bigeneric grafting (pear is *Pyrus*, quince is *Cydonia*).

Seedlings may be grafted on a mature tree for the purpose of hastening their flowering or fruiting. This is a convenience for plant breeders working with fruit trees which, without this aid, might take several years to attain flowering size.

Graftage may be employed when a plant does not make satisfactory growth on its own roots, which explains why many nursery-

men prefer to propagate by budding or grafting certain varieties of roses and of azaleas. It is a common practice among nursery-men to bud or graft named lilacs on plants or cuttings of privet. This practice has been condemned by some who claim that it renders the lilacs subject to a disease known as "graft-blight." It does, however, result in a salable plant in a shorter time, and, if grafted so that ultimately the lilac may form its own root system, it is difficult to see any objection to the practice. In any case it is preferable to working named lilacs on seedling lilacs which are likely to sucker badly and choke out the scion. (Fig. 1).

Grafting and budding may be used when it is desired to produce a plant of special form, as when "weeping" trees (mulberry, *Sophora*, elm, etc.) are worked on a tall stock. Standard or "tree" roses, and "umbrella" catalpas are similarly produced. Various cacti and succulents are often grafted—sometimes to facilitate the culture of a species of weak constitution and sometimes to produce a specimen of fantastic form. Plants of trailing or weak habit of growth may be grafted on sturdy stocks so that their charms may be more effectively displayed. Crab cactus is often grafted on *Pereskia*, and trailing forms of *Cereus* upon up-right growing kinds. Mr. H. O. Bullard made it possible for us to show many of the examples of grafted cacti included in the exhibit.

Grafting is used to adapt plants to soil conditions. For example, plums, which thrive best in heavy soil, may be budded on peach to enable them to grow in sandy soil. It is also used to help trees to withstand a severe climate, as when apples are grafted on a rootstock of known hardiness.

Sometimes grafting may help overcome certain pests. Varieties of grapes originating from *Vitis vinifera*, a species native to Europe and Asia, are badly injured by the grape *Phylloxera*, a louse which causes galls to form on roots and leaves. If, however, these varieties are grafted upon resistant understocks of American origin, they are, to some extent, able to sustain the attacks of these insects.

By grafting upon a suitable understock, plants may be made more resistant to nematodes—e.g., peach on Marianna plum; or to fungus diseases such as foot-rot, or gummosis, of citrus fruits. On the other hand, species susceptible to crown gall are more commonly infected if grafted. One way in which this disease, of bacterial origin, may be spread is by means of a grafting knife used, first to cut diseased and then, without disinfection, to cut healthy tissue.

Fruit trees are sometimes "double-worked" by using one variety for the understock, another for the trunk, while the top, which produces the fruit, is a third. One reason for "double-working" is to splice uncongenial varieties. For example, the Bosc pear cannot satisfactorily be grafted directly on the quince, but if a

Bartlett scion serves as an intermediary, a good union is formed. The practice is also followed to provide good trunks for varieties of unsatisfactory habit. Some European nurserymen double-work the trees they produce for sale because they think that the use of long scions of "stem-builder" varieties produces trees with stouter stems, and reduces the effect on growth of variable seedling understocks, thus making more uniform trees.

"Scrub" apples or other fruits may be made over by "top-working" them to desirable varieties, usually by cleft-grafting. This method also helps the orchardist to keep pace with the vagaries of the public palate by changing trees of a variety which is going out of favor to one that is popular.

Grafting may be used to provide both sexes on one tree in the case of those species which are dioecious; or to associate in one tree varieties capable of successfully cross-pollinating each other but which if grown alone would not be fruitful. Fruit trees are now offered for sale combining several varieties of peach, or pear, or apple, as the case may be, on one tree. These are supposed to be especially valuable to those gardeners who have but little room, but their worth has been questioned.

The repair of wounds in trees may be hastened by bridge-grafting (sometimes compared to skin- and to bone-grafting performed on humans) and this method, together with inarching, is often instrumental in saving the top of girdled trees.

Grafting by inarching, or by merely entwining two conveniently placed small branches, may be used to brace weak crotches.

Grafting for fun is often practiced, as witness the potato + tobacco + tomato graft which combines all the necessities of life—food, solace, vitamins! Apple trees carrying scores of varieties are not uncommon: and grotesque cacti, made still more fantastic by imaginative grafting, are a fad of some cactus "fans."

There is much variety in the technique employed in budding and grafting, but only the more important methods need be mentioned here.

BUDDING

In budding, a single bud, with bark (and sometimes a portion of wood) attached, is inserted under the bark of the stock, usually when the cambium layer is active. The technique commonly followed is that known as *T* (from the shape of the cut in the stock) or *shield budding* (from the shape of the portion inserted). (Fig 2) It is usually performed during the summer when the bark separates readily from the wood. Roses, apples, and peaches are amongst the plants propagated in this way. After the bud is inserted it is tied in place with raffia, waxed cloth strips, or woolen or other soft string. Rubber budding strips were coming into use for holding buds in place and were favorably regarded. Now, owing to war conditions, I suppose we must learn to forget them for a time. If non-elastic material is used for tying the buds, the ligatures

must be cut ten days or two weeks after the bud is inserted, to prevent strangulation of the bud by the tightening of the tie, brought about by increase in diameter of the stock. Budding is usually performed on seedlings one to three years old, but, in the case of roses, the practice is sometimes followed of inserting buds at intervals along the whole length of strong canes of older plants. These canes, after a few days, are then cut into sections and treated as cuttings, or they may be layered. Lilacs may be successfully budded on unrooted cuttings of privet which are inserted in suitable media for rooting.

Patch budding is the method often employed when the plants to be operated on have thick bark, as in some nut trees. A rectangular piece of bark is removed from the stock, and a piece of exactly the same size, containing a bud of the variety to be propagated, is fitted into the depression and tied snugly in place with strips of waxed cloth. A double bladed knife with the blades set parallel, about one inch apart, or a tool with four blades set in a rectangle about $1" \times \frac{1}{2}"$, is often used to facilitate patch budding. *Flute*, *annular*, and *whistle budding* are variants of patch budding. *Plate* and *H budding* are variants of shield budding. In *chip budding* a mortise is cut in the stock and a chip of bark and wood containing a single bud is cut to fit the hole thus made. *Prong budding* is perhaps more nearly akin to scion grafting, in that a small twig is attached to the shield-shaped portion that is slipped under the T cut of the stock.

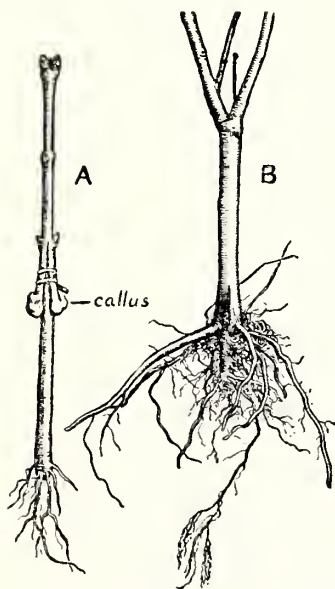


FIG. 1. (A), Lilac winter-graft on privet, callused. (B). Lilac grafted on privet: first season's growth.

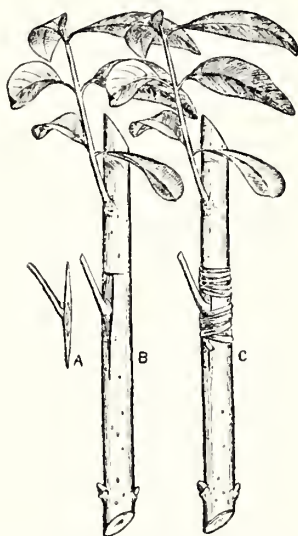


FIG. 2. Lilac bud ready for insertion (A), inserted (B), and tied (C), in privet cutting understock.

GRAFTING

Grafting is the application or insertion of a shoot (the scion), usually not more than one year old and containing one or more buds, to or into the stock. Union takes place in the actively growing tissue (cambium), which is between the bark and the wood. This must be remembered when the stock and scion are of unequal size, and the scion must be so placed that, on one side at least, its cambium is in contact with that of the stock. Scion grafting is usually done in winter or early spring, when the scions are dormant.

The simplest form of grafting is the *splice graft*, commonly used in "working" roses intended for greenhouse forcing. A sloping cut is made in the stock and a similar one in the scion. The cut surfaces are placed together and tied. They are then placed in a close grafting case until united.

Whip grafting (Fig. 3.) is the method frequently used when working on "whole" or "piece" roots. Long sloping cuts are made on both stock and scion. Tongues are made on both stock and scion by vertical cuts starting near the point of the diagonal cuts. Stock and scion are then fitted together and tied with wax string. The finished grafts are tied in bundles and handled in the same way as hardwood cuttings. This type of grafting is done in the winter. Millions of apple trees are propagated this way every year. When a large number of grafts are to be made, machines are used to facilitate tying.

The *side graft* is used a great deal in the propagation of evergreens and Japanese maples. The stocks used are seedlings or cuttings, two or three years old, with stems about the thickness of a lead pencil. They are potted in the spring so that they may be thoroughly established before they are brought into a cool greenhouse in the fall. Three or four weeks before grafting is to start they are placed in a warm house (60° F. - 65° F.) to induce new root formation. A slanting cut is made, one to two and a half inches long, extending almost to the center of the stock. The end of the scion is cut to a long wedge shape and fitted in the cut in the stock with the cambium layers together. The scions are tied in place with twine or rubber strips. The pots are then plunged, sometimes almost horizontally, in peat moss, sand or sphagnum, with the scion uppermost. Usually they are kept in tightly closed propagating cases in the greenhouse. In about four weeks the stock and scion should be united, at which time less humidity is maintained about them, and about one-third of the top of the stock is removed. In another four or five weeks the remainder of the stock may be removed, or in the case of difficult subjects, another third, leaving the remainder to a later date.

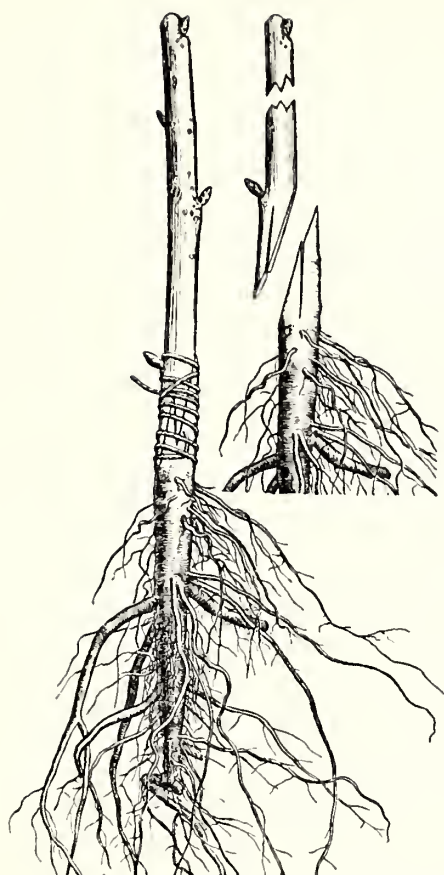


FIG. 3. Whip-graft. Named cherry on cherry seedling.



FIG. 4. Cleft-graft. Largely used in "top-working" fruit trees.

The *veneer* graft is a modification of the side graft. A piece of bark and wood is removed from the stock by a long diagonal cut (about 2 inches) and a shorter almost horizontal cut. The scion is cut to fit. The advantage of these types of graft over splice, whip, saddle, or wedge graft is that if union fails to take place the stock is still available for the insertion of another scion.

The grafting of coniferous and broad leaved evergreens, Japanese maples, magnolias, tree peonies (these are usually worked on "piece" roots of herbaceous peonies), etc., is usually carried out under glass during the first three months of the year.

Cleft grafting (Fig. 4) is the method largely used in making over old fruit trees to new varieties. The scions are cut wedge shaped and inserted in a branch, preferably not more than two inches in diameter. The stock is cut off squarely and a cleft made (with a grafting chisel) in which the scions are placed with their cambium layers in contact with those of the stock. All exposed cut surfaces are then waxed. This work is done in the spring when growth is starting. In all grafting work it is desirable that the stock be in a slightly more advanced stage of growth than the scion. In outdoor grafting the scions may be held back by cutting them during the winter and keeping them in a moist medium in cold storage, or by burying them in a cold, shaded spot out-of-doors. In outdoor grafting all cut surfaces are covered with grafting wax. In some cases (e.g. nut grafting) the entire scion as well as cut surfaces may be coated with melted paraffin wax.

GRAFTING BY APPROACH, OR INARCHING

This practice is adopted when dealing with plants that are difficult to propagate or graft by the usual methods, or when it is desired to work a seedling on an older plant in order to hasten its flowering. In the first case the stocks are grown in small pots. They are then brought near the twigs that are to serve as scions, either by tying them to the branches of the plant to be propagated, by fastening them to a stake, or by standing them on a conveniently situated shelf or platform. A sliver of bark is then removed from both stock and scion, the cut surfaces brought together, and tied. In this method of grafting, the scion is not removed from the the parent plant until it has united with the stock. When approach grafting is used for the purpose of hastening the flowering of seedlings, the same procedure is followed, but in reverse, inasmuch as the seedlings (scions) are in small pots.

Living examples illustrating most of the methods and reasons for grafting are included in the Exhibit.

MONTAGUE FREE.

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BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XXIX

BROOKLYN, N. Y., APRIL 8, 1942

No. 5

THE VICTORY VEGETABLE GARDEN

The Site.—For best results vegetables require an open, sunny situation.

The Soil.—Success in the growing of vegetables depends also on an adequate and constant supply of food and water. Provision for this is assured in part by careful and thorough preparation of the soil.

If time and labor are available, the ground should be dug to a depth of 18 inches or 2 feet, an operation known as trenching or double digging. It is done by first opening a trench 2 feet wide and 1 foot deep at one end of the plot and carrying the soil thus removed to the other end. A 3-inch layer of organic matter—partly decayed manure or leaves, garden trash, etc.—should then be placed in the bottom of the trench and dug into the soil with a spading fork. Continue the work by opening up another trench 2 feet wide and 1 foot deep using the soil so obtained to fill up the first trench. Apply organic matter and work the bottom of the second trench as before. Continue these operations until the end of the plot is reached, where the soil taken from the first trench will be available for filling the last made trench. Then, if rotted manure can be obtained, spread a thin layer over the entire surface and lightly fork it in.

If for any reason it is not feasible to trench the plot, the next best procedure is to cover the surface of the ground with well-decayed manure 2 to 3 inches deep and spade it in, mixing it as deeply as possible. Should manure be unobtainable, use rotted leaves or rotted garden refuse, humus, sedge-peat, or peat-moss. A week prior to planting apply a commercial fertilizer of a formula of approximately 5% nitrogen, 10% phosphoric acid, 5% potash, at the rate of 2 to 3 pounds per 100 square feet and rake it into the upper 3 inches of soil.

Dehydrated cattle manure may be applied at the rate of 10 to 15 pounds per 100 square feet if the bulkier forms of organic matter are not obtainable. Sheep manure at the rate of 10 pounds, or poultry manure at the rate of 5 pounds per 100 square feet may also be substituted. These last two manures are strong and quick acting and should be applied with caution. Mix them well with the soil.

Some soils, especially those in city back yards, are acid, and are benefited by the application of lime. This may be applied in the form of ground limestone, scattering it on the surface of the

TABLE I - PLAN FOR A VEGETABLE GARDEN 40 x 20 FEET

	1' 3"	
Radishes*	- followed by <u>Bush Lima Beans</u>	
	1' 6"	
	<u>New Zealand Spinach</u>	
	1' 6"	
Spinach	- followed by <u>Tomatoes</u> ; or <u>Eggplant & Peppers</u>	
	1' 6"	
	<u>Spinach</u> or <u>Lettuce</u>	
	1' 6"	
Radishes, or Onion Sets,	followed by <u>Tomatoes</u>	
	1' 6"	
	<u>Lettuce</u> or <u>Spinach</u>	
	1' 6"	
	<u>Broccoli</u>	
	1' 6"	
Peas (dwarf, early)		
	1' 6"	
	<u>Cabbage</u> (late)	
	1' 6"	
Peas (dwarf, midseason)		
	1' 6"	
	<u>Celery</u>	
	3'	
	<u>Cabbage</u> (early), followed by <u>Beets</u>	
	1' 6"	
	<u>Kohlrabi</u> , followed by <u>Carrots</u>	
	1' 6"	
Onion (sets),	followed by <u>Carrots</u>	
	1' 6"	
<u>Onion</u> (seeds)	Use thinnings as "bunch" onions	
	1' 6"	
<u>Onion</u> (seeds)		
	1' 6"	
<u>Beets</u>	- followed by <u>Navy Beans</u>	
	1' 6"	
<u>Beets</u>	<u>Snap Beans</u> <u>or</u>	
	1' 6"	
<u>Swiss Chard</u> (1/2 row)	<u>Salsify</u> (1/2 row)	
	1' 6"	
<u>Snap Beans</u> ,	followed by <u>Rutabagas</u>	
	1' 6"	
<u>Snap Beans</u> ,	followed by <u>Turnips</u> or <u>Beets</u>	
	1' 6"	
<u>Carrots</u> ,	followed by <u>Spinach</u>	
	1' 6"	
<u>Carrots</u> ,	followed by <u>Spinach</u>	
	3'	
	<u>Parsnip</u> - 1/2 row	
	1' 6"	
<u>Rhubarb</u> 3 plants 3' apart	<u>Parsnip</u> - 1/2 row	
	1' 3"	

Crops which occupy the ground for the longest time are underlined.

*Sow about 5 feet of row at weekly intervals until May 1.

Feet
0 1 2 3 4 5 6

freshly turned soil and thoroughly raking it in. The amount to use is contingent upon the degree of acidity. To determine whether liming is necessary, use a cheap testing kit obtainable from any large seed or department store. Lime must not be applied in contact with manure.

The Plan.—It is usually advised that the rows, when possible, should run north and south, but it is doubtful if this is important. Perennial vegetables, such as rhubarb and asparagus, should be placed together at one end of the plot, so that they are not in the way when digging or plowing the ground for the next season's work. Crops which are to be followed by other crops later in the season should be grouped together as far as possible, as this facilitates the work and prevents disturbances of the more permanent planting. The accompanying plan (Table I) may provide helpful suggestions.

If your plot is very small and you are inexperienced in vegetable gardening, you would do well to limit yourself to easily-grown crops such as: radish, spinach, leaf lettuce, tomato, onion sets, beets, bush beans, Swiss chard, and carrots. Usually there is not enough room in the small garden for such crops as corn, cucumber, melon, squash, etc. When a rich soil, in a sunny position, is available, however, the three last named, and also tomatoes, may be grown to advantage by training them on the boundary fence, thus economizing space.

Herbs.—Plants grown for seasoning—parsley, mint, thyme, sage, etc.—usually are not needed in large quantities. They can be accommodated in odd corners; or one row may be given up to them.

Planting.—The seed should be sown in drills of suitable depth (see Table II) made with a draw hoe or the edge of a rake, first raking the soil as fine as possible. A line should always be stretched as a guide when making the drills, as this insures a straight row and makes cultivating easier. Sow the seed thinly and evenly in the drills, cover with fine soil and firm with the back of a hoe or the foot. Use of a board or boards about 10 inches wide and of convenient length to stand on while sowing seed will prevent the soil from becoming hard caked from too much trampling.

When the seedlings are an inch or two high they may be thinned according to distances indicated in Table II.

Cultivation.—When the young plants appear, the soil around them must be hoed or scratched in some way to break the surface crust. This allows air circulation through the soil, keeps down weeds, and provides a soil blanket, or dust mulch, which assists in the conservation of moisture. If the weather permits, the surface should be cultivated in this way every week or ten days. It is important to stir the surface of the soil as soon after a rain as it is possible to work without the earth sticking to the hoe, in order to prevent undue evaporation of water.

Watering.—Plants take in their food from the soil only in liquid form, therefore a plentiful supply of water is helpful. When watering is necessary, give a thorough soaking followed by cultivating when the soil is dry enough. Surface sprinkling does not water the plants.

TABLE II.

Time to Plant, Depth to Plant, Distance between the Rows and in the Rows, and Quantity of Seed required for a 100 ft. Row.

<i>Vegetables</i>	<i>Time to plant</i>	<i>Depth</i>	<i>Distance between rows</i>	<i>Distance in the rows</i>	<i>Approx. Quantity</i>
Bean (pole)	May 20 to June 20	1 in. ...	4 ft.	{ in hills 2 ft. apart, about 4 seeds to a hill.	1/4 lb.
Bean (pole lima) ...	May 20 to June 20	1 in. ...	4 ft.		1/2 lb.
Bean (dwarf snap) .	May 10 to Aug. 1 ...	1 in. ...	1 ft. 6 in..	3 in.	1/2 lb.
Beet.	April to Aug. 1 ...	1 in. ...	1 ft. 6 in..	4 in.	1 oz.
Cabbage (early) ...	Feb. indoors; plants set out in Mar.	1/4 in. ...	3 ft.	{ 2 ft.	{ 1 oz. will produce about 2000 plants
Cabbage (late)	May, in beds; plants set out in July.	1/4 in. ...	3 ft.		
Carrot.	April to July.	1 in. ...	1 ft. 6 in..	3 in.	1/2 oz.
Cauliflower (early)	Feb. indoors; plants set out in Mar.	1/4 in. ...	3 ft.	{ 2 ft.	{ 1 oz. will produce about 2000 plants
Cauliflower (late) .	May, in coldframe; plants set out in July.	1/4 in. ...	3 ft.		
Celery.	Mar. indoors; plants set out in May.	1/8 in. ...	3 ft.	9 in. to 1 ft..	{ 1 oz. about 3000 plants
Corn.	May 10 to July 10. ...	2 in. ...	3 ft.	1 ft.	2 oz.
Egg-plant.	Mar. indoors; plants set out in late May or early June	{ 1/4 in. ...	{ 3 ft.	{ 3 ft.	{ 1 oz. will produce 600 plants
Lettuce.	April to Aug.				
Onion (seed)	April to May	1 in. ...	1 ft. 6 in..	4 in.	1/2 oz.
Onion (sets)	Mar. 15 to May 15. ...	2 in. ...	1 ft.	2 in.	2 lbs.
Parsley.	April	1/2 in. ...	1 ft. 6 in..	6 to 8 in.	1/4 oz.
Parsnip.	April	1 in. ...	1 ft. 6 in..	6 in.	1/2 oz.
Peas (dwarf)	Mar. 15 to May 15. ...	2 in. ...	2 to 3 ft.	2 in.	1 lb.
Peas (tall)	Mar. 15 to May 15. ...	2 in. ...	4 to 6 ft.	3 in.	1 lb.
Peppers.	Mar. indoors; plants set out in late May or early June	{	{ 3 ft.	{ 2 ft.	{ small package
Potatoes.	April 15 to June				
Radish.	Mar. to Sept.	1/2 in. ...	1 ft.	2 in.	1/2 oz.
Spinach.	Mar and Sept.	1 in. ...	1 ft. 6 in..	4 in.	1/2 oz.
Swiss Chard.	April	1/2 in. ...	1 ft. 6 in..	6 in.	1 oz.
Tomato.	Mar. indoors; plants set out in late May or early June	{	{ 3 ft.	{ 3 ft.	{ 1 oz. will produce over 1000 plants
Turnip.	April and Sept.				

MARGARET M. DORWARD
MONTAGUE FREE

collected by ^{me} 2/17/01

